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Groundwater Monitoring and Field Sampling Plan for Operable Unit 10-08

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Groundwater Monitoring and Field Sampling Plan for Operable Unit 10-08

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**Prepared for the
U.S. Department of Energy
DOE Idaho Operations Office**

ABSTRACT

This plan describes the groundwater sampling and the water level monitoring that will be conducted to evaluate contaminants in the Snake River Plain Aquifer entering and leaving the Idaho National Laboratory. The sampling and monitoring locations were selected to meet the data quality objectives detailed in this plan. Data for the Snake River Plain Aquifer obtained under this plan will be evaluated in the Operable Unit 10-08 remedial investigation/feasibility study report and will be used to support the Operable Unit 10-08 Sitewide groundwater model.

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ACRONYMS

AMS	accelerator mass spectrometry
bls	below land surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CoC	chain of custody
COC	contaminant of concern
COPC	contaminant of potential concern
DEQ	[Idaho] Department of Environmental Quality
DOE	U.S. Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
DOT	Department of Transportation
DQO	data quality objective
DR	decision rule
EPA	U.S. Environmental Protection Agency
FFA/CO	Federal Facility Agreement and Consent Order
FTL	field team leader
FY	fiscal year
HASP	health and safety plan
ICP	Idaho Cleanup Project
INEEL	Idaho National Engineering and Environmental Laboratory
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
MCL	maximum contaminant level

MFC	Materials and Fuels Complex
OU	operable unit
PCE	tetrachloroethene
PE	performance evaluation
PPE	personal protective equipment
PSQ	principal study question
QAPjP	quality assurance project plan
QA/QC	quality assurance/quality control
RI/FS	remedial investigation/feasibility study
ROD	record of decision
RTC	Reactor Technology Complex (formerly Test Reactor Area [TRA])
RWMC	Radioactive Waste Management Complex
SAM	Sample and Analysis Management
SAP	sampling and analysis plan
SDWS	secondary drinking water standard
SRPA	Snake River Plain Aquifer
TAN	Test Area North
TCE	trichloroethene
USGS	United States Geological Survey
VOC	volatile organic compound
WAG	waste area group
WGS	Waste Generator Services

Groundwater Monitoring and Field Sampling Plan for Operable Unit 10-08

1. INTRODUCTION

A number of radioactive and hazardous contaminants have been found in the Snake River Plain Aquifer (SRPA) beneath the Idaho National Laboratory (INL) site. Many of these contaminants are the result of INL operations conducted over the past 50 years. The potential impacts to the groundwater from these INL activities are under investigation by Operable Unit (OU) 10-08. The critical importance of the SRPA to the residents of eastern Idaho has been recognized by the U.S. Environmental Protection Agency (EPA) with the SRPA's designation as a sole-source aquifer.

Investigation and cleanup of contaminated areas at the INL Site are performed within the framework of the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (FFA/CO) (DOE-ID 1991) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.). Within this framework, the INL Site is divided into 10 "waste area groups" (WAGs), and each WAG is further divided into more manageable "operable units" (OUs).

WAG 10 at the INL Site encompasses miscellaneous surface-contamination sites and liquid-disposal areas that are outside the boundaries of the INL's other nine WAGs (Figure 1-1). The OU 10-08 addresses potential contamination issues associated with the SRPA, which are outside the purview of the other WAGs. A major component of the OU 10-08 RI/FS is a numerical model to predict contaminant transport in the aquifer and calculate risk from groundwater use. Operable Unit 10-08 also includes new sites discovered within the other WAGs after their records of decision (RODs) have been signed.

1.1 Project Purpose and Scope

This plan establishes the groundwater monitoring and sampling requirements for the OU 10-08 remedial investigation/feasibility study (RI/FS). Operable Unit 10-08 is responsible for determining the nature and extent of contamination in the SRPA from INL operations and the resulting potential risks to human health and the environment. The results of the groundwater sampling will be used to help ensure that environmental impacts associated with releases of hazardous substances at the INL Site are thoroughly investigated and appropriate actions are taken to protect the public and the environment, as set forth in the FFA/CO (DOE-ID 1991) and CERCLA (42 USC § 9601 et seq.).

The comprehensive nature and scope of OU 10-08 necessitates that monitoring data be collected over many years and long-term integration be maintained among individual WAGs in order to ensure that the data needed is available and of sufficient quality for preparation of the comprehensive RI/FS. The large area encompassed by OU 10-08 (i.e., the entire 890-mi² INL Site) and the long groundwater travel times across the area require monitoring of water quality and water levels over many years to correctly and adequately characterize the SRPA for risk-assessment calculations. In addition, it is critical that the OU 10-08 groundwater monitoring program interface with groundwater monitoring by individual WAGs to create a synergistic and integrated understanding of the SRPA flow regime, contaminant source terms, and subsurface transport within the INL Site boundaries. Results from the data collected under this plan will support development of the OU 10-08 groundwater conceptual model and will be used to calibrate the numerical simulation. An integrated understanding of the overall quality of the SRPA beneath the

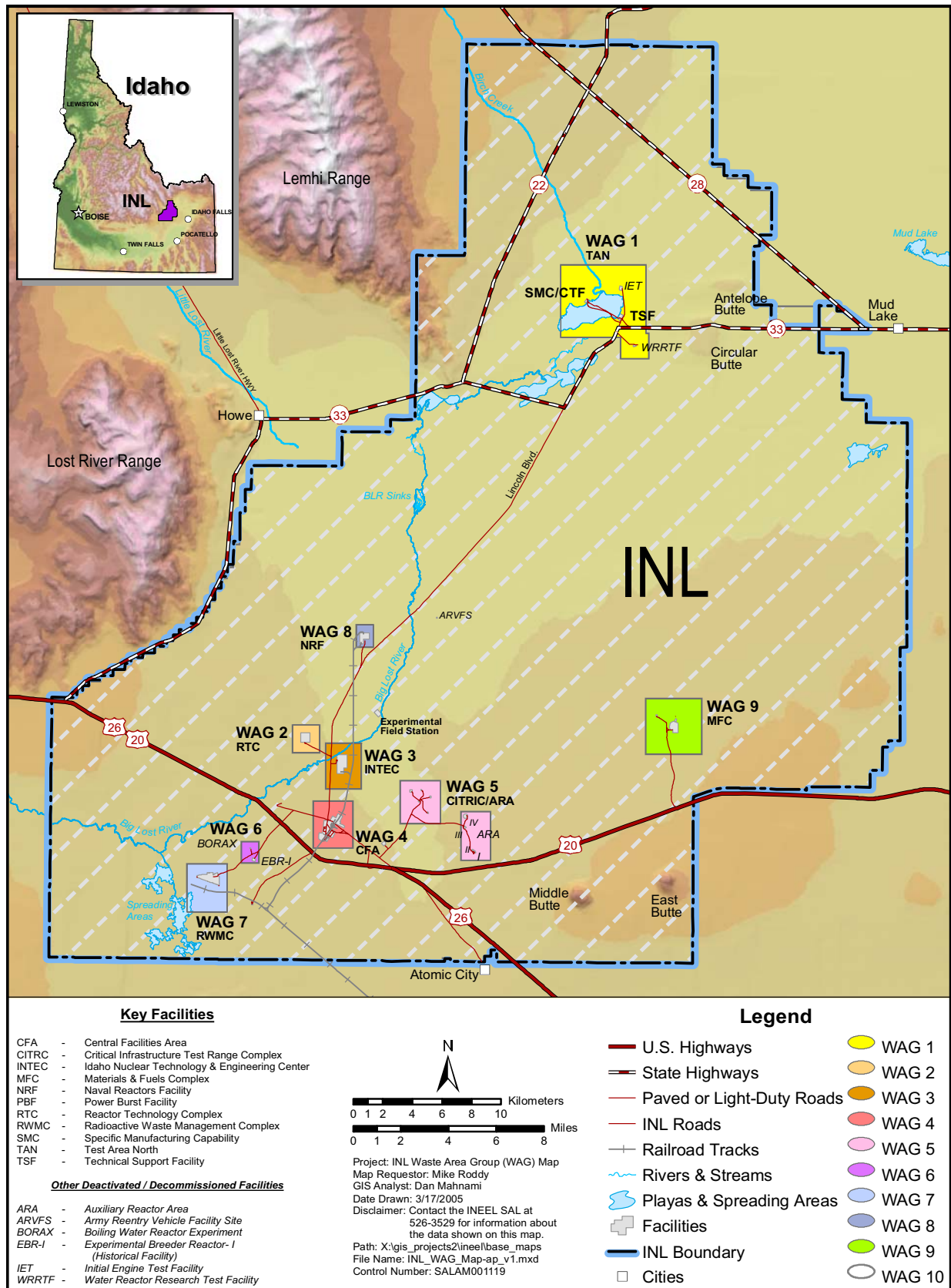


Figure 1-1. Idaho National Laboratory site map showing Waste Area Group locations.

INL Site is critical for communicating INL impacts to other SRPA water users. Another critical purpose of OU 10-08 groundwater monitoring is to collect tangible evidence that water contaminated above maximum contaminant levels (MCLs) or risk-based levels does not extend beyond the downgradient boundaries of INL.

Development of this plan was based on the initial 4 years of sampling and the data gaps/data needs identified in the *Waste Area Group 10, Operable Unit 10-08, Remedial Investigation/Feasibility Study Work Plan (FINAL)* (DOE-ID 2002a). The data gaps identified in the OU 10-08 RI/FS work plan (DOE-ID 2002a) include the lack of consistent or accurate groundwater elevation measurements, lack of consistent analytical groundwater data collected at the scale of the INL, and new wells needed to address monitoring requirements in unmonitored locations. The installation of new monitoring wells is covered in another plan (the *Operable Unit 10-08 Prioritization of Drilling Locations for Fiscal Year 2005 and Outyears* [ICP 2005]). The data collected under this groundwater monitoring plan will characterize and assess INL-wide groundwater risks and will ultimately be used in the OU 10-08 ROD. The scope of this plan is as follows:

1. Collect data to fill data gaps in existing knowledge needed to design, develop, and calibrate the OU 10-08 groundwater model
2. Collect data adequate to assess the risk to human health and the environment from groundwater contamination at the INL for the OU 10-08 RI/FS and subsequently the OU 10-08 ROD
3. Collect data sufficient to demonstrate that groundwater contamination does not extend at significant levels beyond the downgradient boundaries of the INL.

Groundwater monitoring for OU 10-08, as described in this plan, is designed to (a) support the data needs for the OU 10-08 RI/FS and (b) support the transition of groundwater monitoring responsibilities into WAG 10 as the other individual WAGs are closed out under CERCLA. Water quality data are needed for the OU 10-08 RI/FS for the following purposes:

- Supporting the aquifer model calibration
- Determining whether mixing of plumes from individual WAGs can create a cumulative risk not addressed by individual WAGs
- Corroborating WAG-specific groundwater monitoring.

Note that groundwater monitoring performed under this plan will not duplicate monitoring performed by other WAGs. The quality assurance project plan (QAPjP) (DOE-ID 2004a) describes the processes and programs that ensure generated data will be suitable for their intended use.

As the INL CERCLA projects move toward completion, long-term monitoring activities will be performed under WAG 10 and the INL Long-Term Stewardship program. Sitewide institutional controls and the comprehensive five-year review have already been consolidated under Long-Term Stewardship. To support CERCLA compliance monitoring at the INL, a comprehensive Sitewide (WAG 10) groundwater monitoring plan will be prepared after the OU 10-08 ROD is signed. The comprehensive monitoring plan will encompass all groundwater sampling activities managed by the individual WAGs, and it will supersede and replace all existing groundwater monitoring plans.

1.2 Regulatory Background

On July 14, 1989, the EPA proposed placing the Idaho National Engineering and Environmental Laboratory (INEEL) (now the INL) on the National Priorities List of the “National Oil and Hazardous Substances Pollution Contingency Plan” (40 *Code of Federal Regulations* [CFR] 300). The EPA Region 10 (with public participation during a 60-day comment period following the proposed listing) issued a final rule on November 21, 1989, that listed the INL on the National Priorities List (54 Federal Register [FR] 48184). The U.S. Department of Energy (DOE) Idaho Operations Office (DOE Idaho) is the lead agency for remedy decisions. The EPA Region 10 and Idaho Department of Environmental Quality (DEQ) approve those decisions.

The FFA/CO (DOE-ID 1991) establishes the procedural framework and schedule for response actions at the INL in accordance with CERCLA, the Resource Conservation and Recovery Act (42 USC § 6901 et seq.), and the Idaho Hazardous Waste Management Act (Idaho Code § 39-4401 et seq.). The FFA/CO signed by DOE Idaho, EPA Region 10, and the State of Idaho identifies 10 WAGs at the INL Site (Figure 1-1).

The FFA/CO defines WAG 10 as the INL Site boundary or beyond, as necessary, to encompass any real or potential impact from INL activities and any areas within the INL Site not covered by other WAGs (DOE-ID 1991). WAG 10 encompasses a large area, and much of that area is uncontaminated. WAG 10 also is defined as the INL Site boundary minus WAGs 1 through 5, WAGs 7 through 9, and the Jefferson County landfill. The FFA/CO stated that the WAG 6 comprehensive RI/FS would be incorporated into the OU 10-04 RI/FS. The OU 10-08 encompasses surface sites currently transferred from other OUs, new sites that may be identified after the OU 10-08 ROD is signed, and INL groundwater for sites with completed RODs. With concurrence from the regulatory agencies, any new site in a WAG whose ROD has been signed also can be included in OU 10-08. If an individual WAG is closed out prior to signature of the WAG 10-08 ROD, the individual WAG will continue to follow its long-term monitoring plan under the purview of Long-Term Stewardship.

2. SITE DESCRIPTION AND BACKGROUND

The INL Site is a U.S. government-owned facility managed by the DOE. The INL Site occupies approximately 890 mi² of the northwestern portion of the eastern Snake River Plain in southeast Idaho (Figure 1-1), and the eastern boundary of the INL Site is located 32 mi west of Idaho Falls, Idaho. Depth to water varies from approximately 200 ft in the northeast corner of the INL Site to 1,000 ft in the southeast corner. Water table contours for the SRPA underneath the INL Site are depicted in Figure 2-1. The regional groundwater flow is to the south-southwest. Locally, however, the direction of groundwater flow is affected by recharge from rivers, surface water spreading areas, pumpage, and heterogeneity in the aquifer. Across the southern INL Site, the average gradient of the water table is approximately 5 ft/mi.

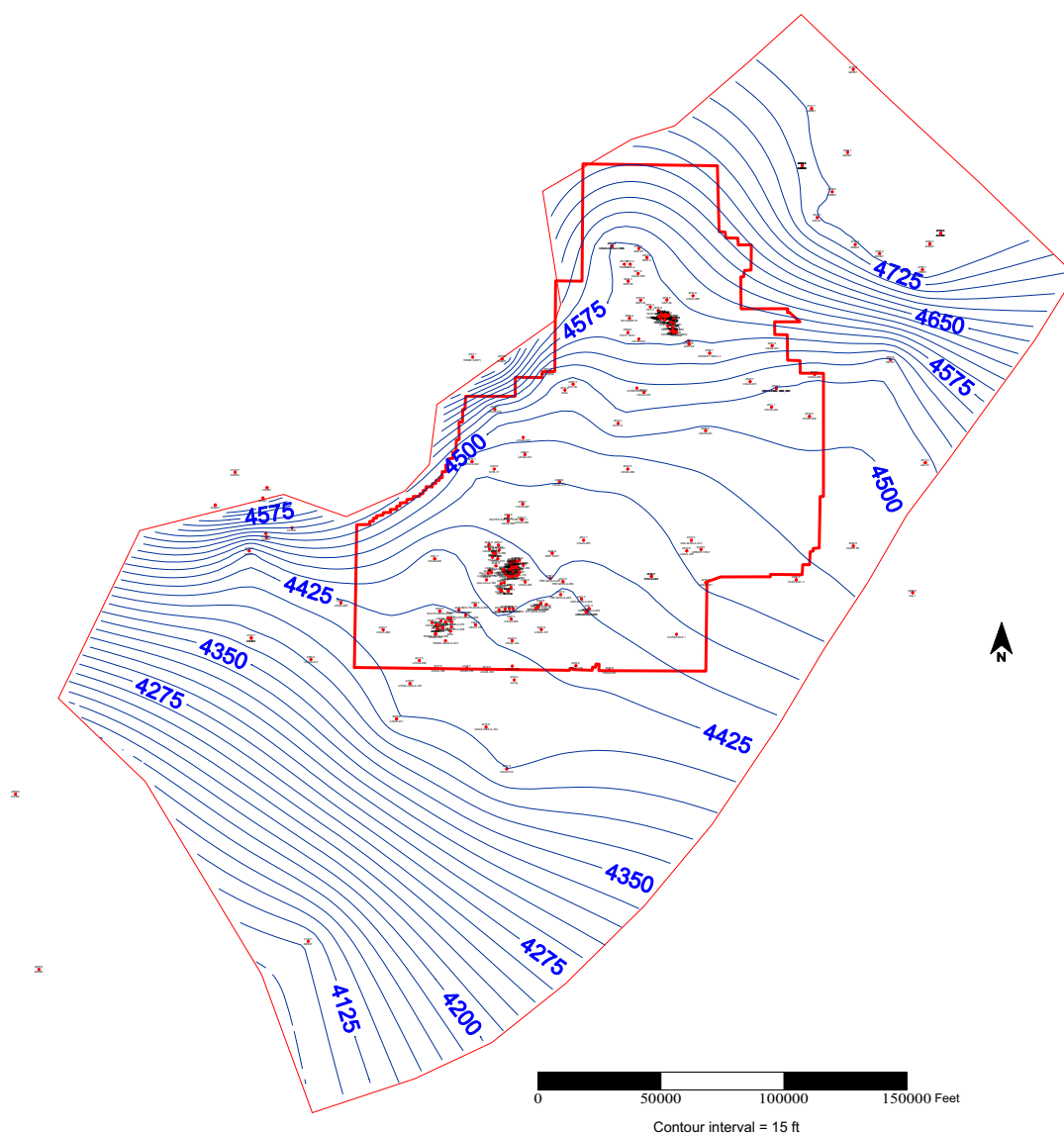


Figure 2-1. Water table elevation (ft) in blue based on June 2004 data (DOE-ID 2005). Bold red lines show the outline of INL and the boundaries of the map in light red indicate the boundaries of the Operable Unit 10-08 subregional groundwater model.

2.1 INL Groundwater Monitoring

Contaminant monitoring has been conducted extensively at the INL Site since 1949 by federal and state agencies, universities, and private contractors to evaluate the distribution and transport of contaminants in groundwater. The objective of monitoring is to protect human health and the environment. The DOE has sponsored monitoring activities conducted by the United States Geological Survey (USGS), State of Idaho INL Oversight Program, INL contractors, Idaho State University, and the University of Idaho. INL monitoring networks now include more than 400 wells in the SRPA, vadose zone, and perched groundwater bodies. Sample results from these wells provide information on the distribution of contaminants in groundwater and define changes in contaminant concentrations in response to natural processes of dispersion, radioactive decay, and biological activity and to changes due to active remediation being performed at INL sites.

Contaminated groundwater at the INL Site has been detected at the Naval Reactors Facility, the Radioactive Waste Management Complex (RWMC), the Reactor Technology Complex (RTC) (formerly known as Test Reactor Area [TRA]), the Central Facilities Area (CFA), the Idaho Nuclear Technology and Engineering Center (INTEC), and Test Area North (TAN) (Figure 1-1). Currently, the Idaho Cleanup Project and the USGS conduct monitoring to satisfy various WAG-specific program objectives. Some wells are monitored by smaller programs (e.g., Materials and Fuels Complex [formerly Argonne National Laboratory-West]). The wells are monitored as frequently as quarterly, but monitoring ranges to annually, depending on the data needs. A comprehensive Environmental Data Warehouse is operated by the Long-Term Stewardship program to maintain records of all sampling results. Currently, Sample and Analysis Management (SAM) maintains the groundwater sampling records independently for the Idaho Cleanup Project and the USGS.

2.2 Previous OU 10-08 Sampling

Results of previous groundwater sampling events conducted in support of the WAG 10 RI/FS are provided in the Fiscal Year (FY) 2003 OU 10-08 RI/FS annual report (DOE-ID 2004b), the FY 2003 OU 10-08 RI/FS supplemental annual report (DOE-ID 2004c), the FY 2004 OU 10-08 RI/FS annual report (DOE-ID 2005) and the FY 2005 annual report (DOE-ID 2006). Groundwater wells sampled under prior OU 10-08 groundwater monitoring plans were routinely sampled for volatile organic compounds (VOCs) (Appendix IX target analyte list), metals (filtered), anions (including bicarbonate), and radionuclides (I-129, tritium, Tc-99, gross alpha, gross beta, gamma spectrometry, uranium isotopes, and Sr-90). The locations of the guard, baseline, and boundary wells that were sampled in 2003 and 2004 are shown on Figure 2-2. In 2005, a distal well category was added and USGS-100 was added to the list of guard wells (Figure 2-3). The four well categories were selected to (a) monitor contaminants coming onto the INL Site (baseline), (b) provide early warning downgradient from facilities (guard), (c) monitor contaminants leaving the INL Site (boundary), and (d) monitor wells downgradient of the INL Site (distal). The wells sampled for WAG 10 include wells that are not normally sampled under the other WAGs.

Three water quality sampling events were performed in FY 2003. A sampling event was performed annually in both FY 2004 and FY 2005. Two sampling events in FY 2003—during November 2002 and June 2003—were conducted on the standard suite of guard, baseline, and boundary wells identified in the OU 10-08 RI/FS work plan (DOE-ID 2002a). In addition to wells sampled during the two standard sampling events, nine wells were sampled for explosives in March 2003 in order to satisfy the requirements of the OU 10-04 ROD associated with potential contamination in the SRPA (DOE-ID 2002b). In addition to the regular suite of analytes, the Highway 3 well was sampled for

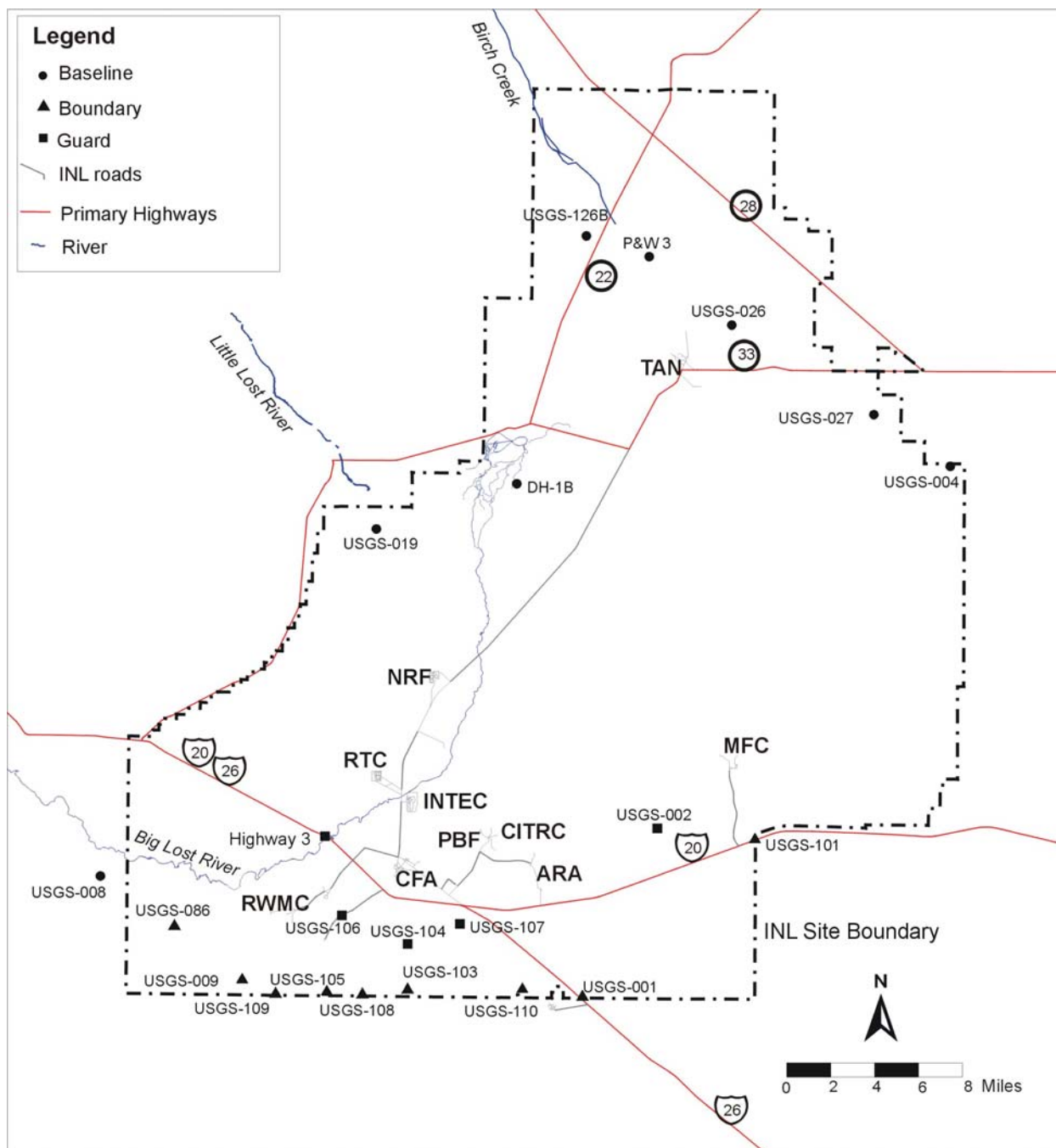


Figure 2-2. Map showing the locations of baseline, boundary, and guard wells sampled at the INL Site in 2003 and 2004.

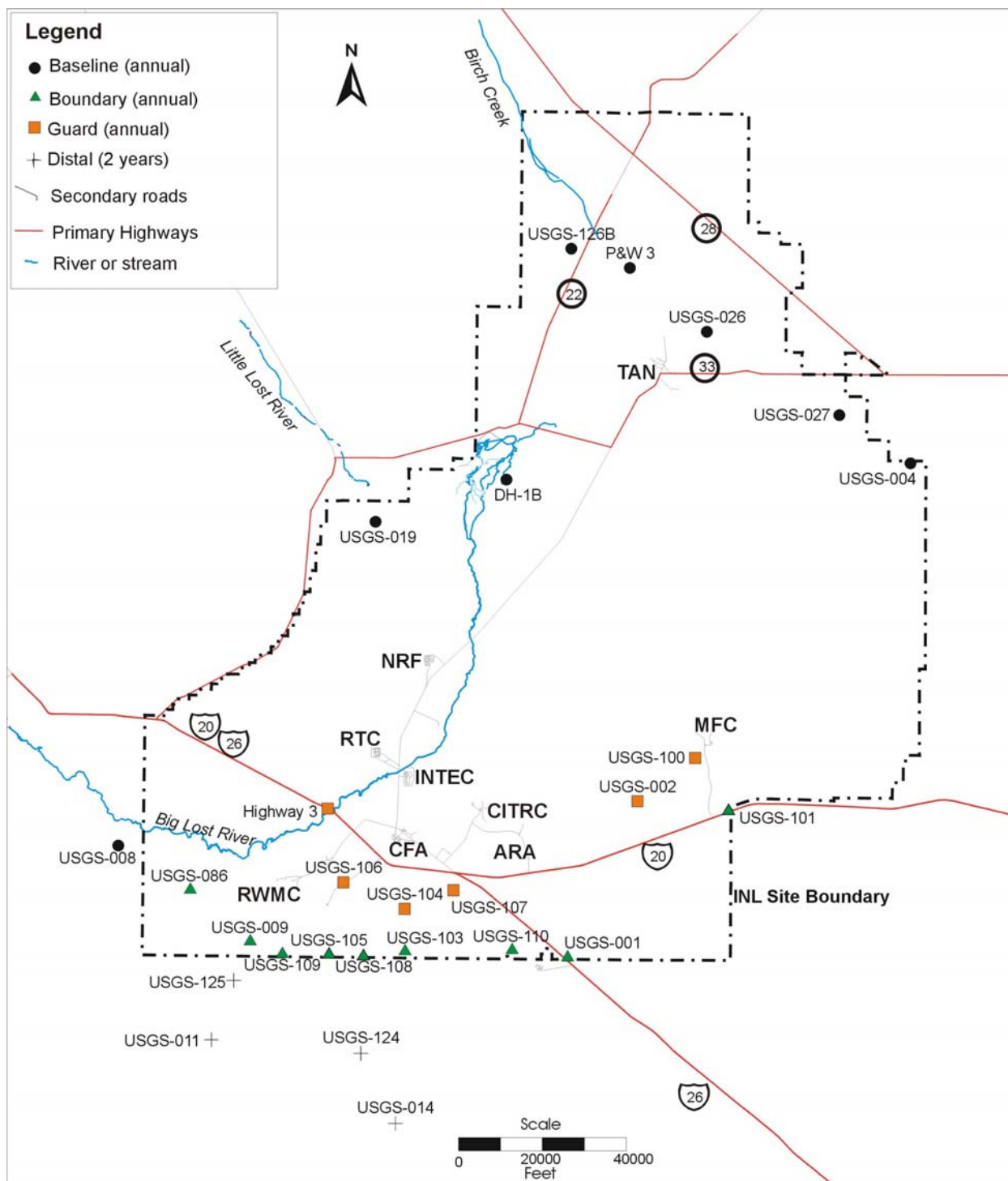


Figure 2-3. Map showing the locations of baseline, boundary, guard and distal wells sampled at the INL Site in 2005.

nitroaromatics, and Wells USGS-009, -086, -105, and -109 were sampled for C-14 in June and July of 2003. During June and July of 2004 and 2005, routine groundwater sampling was conducted for the standard suite of guard, baseline, and boundary wells. In 2005, four distal wells south of the INL Site boundary also were sampled.

2.2.1 Data Summary for Previous OU 10-08 Sampling Events

The concentrations of gross alpha, gross beta, and uranium isotopes in the suite of guard, baseline, and boundary wells are similar to background values (Knobel et al. 1992; USGS 1999). Tritium has been detected consistently in two wells, USGS-104 and -106, at concentrations currently near 1,000 pCi/L, which is well below the MCL of 20,000 pCi/L. Currently, both wells exhibit a downward trend in tritium concentration.

A few VOCs were detected at low concentrations and well below MCLs in FY 2003, FY 2004, and FY 2005 sampling events. The detections of VOCs have been inconsistent and in most cases can be attributed to laboratory contamination.

Review of the sampling results from the WAG 10 boundary, baseline, and guard wells indicates that all metals—except for thallium—and anions are below their respective MCLs or secondary MCLs. Thallium was reported at concentrations above its MCL in two wells, but when analyzed at a lower detection limit, thallium was not detected in these wells. Zinc concentrations in the groundwater samples from USGS-009, -086, -103, -104, -105, -106, -108, -109, and the Highway 3 well were elevated. The elevated zinc concentrations in these groundwater monitoring wells are the result of corroding galvanized discharge/riser pipe used in their construction (ICP 2004a, 2004b).

The major anion and cation chemistry of Baseline Wells USGS-004 and -027 suggests off-Site influences. Well USGS-004 has a much higher nitrate concentration than other wells monitored for WAG 10, and this concentration is greater than the USGS background range for the INL Site (DOE-ID 2004c). The higher nitrate concentration in this well reflects an off-Site agricultural influence. In addition, USGS-004 shows an influence of infiltration from Mud Lake, based on oxygen isotope ratios that are indicative of evaporative effects (USGS 1999). The composition of USGS-027 is high in sodium and chloride compared to the other WAG 10 wells and background values for the SRPA. Wells USGS-004 and -027 also have higher conductivity values than the other wells, suggesting an off-Site influence. In the vicinity of USGS-004 and -027, groundwater gradients are south to southwest based on data in the FY 2003, FY 2004, and FY 2005 annual WAG 10 RI/FS reports (DOE-ID 2004b, 2005, and 2006). Considering that the locations of these wells are on or near the INL boundary, this data indicates that the groundwater in these wells is influenced by off-Site sources.

2.2.2 Data Summary for Explosive Sampling Events

Historical land uses at the INL Site include munitions and explosives testing. Potential contamination of the soil and groundwater due to the chemical compounds used in these explosives led to the March 2003 OU 10-08 sampling event and the additional sampling of the Highway 3 well in June 2004. Sampling was conducted in wells proximal to potential explosive contamination sources. The wells were sampled for trinitrotoluene (TNT), cyclotrimethylene trinitroamine (Royal Demolition Explosive [RDX]), 1,3,5-trinitrobenzene, 4-amino-2, 6-dinitrotoluene, 2,4-dinitrotoluene, and 2,6-dinitrotoluene. Analytical results for wells sampled for explosives or nitroaromatics showed that all compounds were below detectable levels in the SRPA.

2.3 Other Studies Relevant to OU 10-08

The USGS has conducted several contaminant-transport studies that have a bearing on OU 10-08 monitoring and groundwater modeling. The primary tracers used for the USGS groundwater flow and contaminant migration studies were Cl-36 and I-129; Tc-99 was used to a lesser extent. These tracers—I-129, Cl-36, and Tc-99—are present in the SRPA as a result of past facility operations and are opportunistic tracers. They were not injected as part of a tracer study. I-129 and Cl-36 are excellent

tracers for groundwater flow and contaminant migration paths. Cl-36 is an excellent tracer, because it is a conservative anion, and I-129 is an excellent tracer in anion form. In addition, I-129 and Cl-36 were selected based on their ability to distinguish sources and to be tracked over great distances. Samples collected for the I-129 and Cl-36 studies were analyzed using the low-detection limit accelerator mass spectrometry (AMS) method; samples collected for Tc-99 studies were analyzed using the thermal ionization mass-spectrometry method.

In addition to studies within and just south of the INL Site boundary, the USGS has conducted sampling farther south—in the Magic Valley area—to evaluate potential impacts from INL activities. The USGS sampling from the southern boundary of the INL Site to the Hagerman area (Magic Valley) was conducted from 1989 to 2003. In the initial sampling in 1989, samples were collected from 55 sites. Subsequent annual sampling was performed at approximately one-third of the wells, so that all of the original sites were sampled every 3 years.

2.3.1 USGS Studies of Contaminant Migration

A Cl-36 plume extending from INTEC and RTC to the southern INL Site boundary is described in two studies (Beasley et al. 1993; Cecil et al. 2000). A comparison of tritium and Cl-36 data indicated that the Cl-36 plume extended beyond the area of the tritium plume defined by the 500-pCi/L concentration for tritium. Cl-36 also was detected in a well at the RWMC (Beasley et al. 1993). Based on the first detection of Cl-36 in USGS-011 and -014 (see Figure 4-1) as early as 1977, contaminant/groundwater flow velocities of approximately 3 ft/day were estimated (Cecil et al. 2000).

Sampling in 1991 and 1992 identified an I-129 plume extending from INTEC to beyond the southern INL Site boundary (Mann and Beasley 1994). It should be noted that the I-129 concentrations south of the INL Site boundary are low (at least two orders of magnitude below the MCL of 1 pCi/L). Groundwater flow velocity from INTEC past the southern boundary of the INL Site was estimated at 6 ft/day based on movement of I-129 (Mann and Beasley 1994). I-129 also was detected at low concentrations in USGS-90, which is located near the RWMC (Mann and Beasley 1994). The occurrence of a low I-129 concentration near the RWMC suggests that a groundwater flow path from INTEC exists and that INTEC/RWMC plumes could be commingling. The interpretation of flow paths is complicated, because I-129 also is present in the wastes emplaced in the RWMC. Sampling of Magic Valley wells and springs south of the INL Site from 1992 to 1994 indicated background I-129 concentrations (Cecil et al. 2003). Although a Cl-36 plume originates from both RTC and INTEC, I-129 appears to originate from INTEC but not from RTC (Mann and Beasley 1994). In addition to samples collected during the Mann and Beasley study, I-129 samples were collected south of INTEC in 1977, 1981, 1986, and 1990.

Sampling and analysis for Tc-99 using the low-detection limit thermal ionization mass-spectrometry method indicated a plume from INTEC extending past the southern boundary of the INL Site (Beasley et al. 1998). Tc-99 was detected in the RWMC production well, which is consistent with the low-detection limit I-129 data. This detection suggests that a groundwater flow path extends from INTEC to the RWMC and that commingling of INTEC and RWMC contaminant plumes is possible. However, the interpretation of flow paths is complicated, because Tc-99 is also present in the wastes emplaced in the RWMC. This plan proposes additional sampling to investigate that possibility.

In addition to the radiological analytes discussed above, the USGS has mapped concentrations of chlorofluorocarbons (CFCs) in the SRPA (Busenberg et al. 2001). The CFC analyses were performed to estimate the age of groundwater beneath the INL Site, but they indicated the presence of several CFC anomalies that could be used as groundwater flow tracers. The CFC study indicated a plume of dichlorodifluoromethane (F-12) originating from INTEC and a 1,1,2-trichloro-1,2,2-trifluoroethane

(F-113) plume originating at the RWMC. However, the CFC concentrations were very low and required special detection methods.

2.3.2 Magic Valley Sampling

The USGS has performed extensive sampling south of the INL Site boundary in the Magic Valley (Twining and Rattray 2003; Bartholomay and Twining 2000; Rattray and Campbell 2003; Bartholomay et al. 2001). When detected, concentrations of radiological analytes, such as tritium, gross alpha, and gross beta, were present at background levels and were below MCLs. Results for organics and inorganics also are reported in the documents referenced above. However, the USGS has discontinued sampling of wells south of the INL Site boundary to the Hagerman area (Magic Valley). The Magic Valley sampling is proposed to be performed by the State of Idaho oversight sampling program. The sampling proposed in Section 4 of this work plan is not part of the program that is to be performed by the State of Idaho oversight sampling program.

3. FIELD SAMPLING PLAN OBJECTIVES

The data quality objective (DQO) summary in Table 3-1 is a modification of the original DQOs presented in the WAG 10 RI/FS work plan (DOE-ID 2002a) and the DQOs in the first revision of this plan. The revised DQOs for groundwater monitoring reflect the need to collect data that can be used in ascertaining the potential for plumes to commingle, vertical distribution of contaminants, and in calibrating the groundwater flow model.

The EPA developed the DQO process as a means to “improve the effectiveness, efficiency, and defensibility of decisions” used in the development of data collection designs (EPA 2000). The DQO process is a systematic procedure for defining data collection criteria based on the scientific method. This process consists of seven iterative steps that yield a set of principal study questions (PSQs) and decision statements that must be answered to address a primary problem statement. The seven steps of the DQO process are as follows:

- Step 1: State the problem
- Step 2: Identify the principal study questions
- Step 3: Identify the inputs to the decision
- Step 4: Define the study boundaries
- Step 5: Develop decision rules (DRs)
- Step 6: Specify tolerable limits on the decision
- Step 7: Optimize the design for obtaining data.

The DQOs for groundwater monitoring associated with OU 10-08 are shown in Table 3-1.

Table 3-1. Data quality objectives for groundwater monitoring associated with Operable Unit 10-08 groundwater monitoring.

1. Problem Statement:		2. Principal Study Questions:		3. Inputs to the Decision:	4. Define the Study Boundaries:
1. What data are required to assess current conditions and future changes in the nature and extent of contamination plumes at the downgradient INL Site boundary?		PSQ 1a. Are the downgradient nature and extent of all contaminant plumes within OU 10-08 defined? Do plumes commingle?		The following are inputs to PSQ-1a: Results from site monitoring activities performed under OU 10-08 and the other WAGs Revision of the OU 10-08 groundwater numerical model, incorporating updated site conceptual model information A geochemical study of known contaminant sources using anthropogenic contaminants and stable isotopes to help identify groundwater flow and contaminant migration pathways.	This study focuses on the transport of contaminants of potential concern (COPCs) in the groundwater from facilities within the INL Site to its boundary and beyond. WAG 10 includes all areas within the INL Site that are not included in the routine sampling programs for the other WAGs (principally WAGs 1, 3, 4, and 7) (Figure 1-1). However, the groundwater modeling will also make use of data collected by the individual WAGs. This plan will be in effect until the OU 10-08 ROD is signed. It is anticipated that a post-ROD long-term monitoring plan will be developed after the ROD is signed.
		PSQ 1b. Are groundwater and contaminant flow paths understood and identified?		The following are inputs to PSQ-1b: Groundwater contaminant data collected by WAG 10 and other WAGs Measurement of water levels in monitoring wells installed in the SRPA Geochemical studies to identify flow paths Geochemical or biological reactions along flow paths that can attenuate or degrade contaminant levels.	
	2. Will concentrations of selected COPCs meet regulatory standards (MCLs) or other applicable risk-based concentrations at all locations within the INL Site by 2095?		PSQ-2. Are groundwater contaminant concentrations within the INL Site projected to comply with MCLs or other acceptable risk-based concentrations in 100 years?		
5. Develop a Decision Rule:		6. Specify Tolerable Limits on Decision Errors:		7. Optimize the Design:	
DR-1a. If the groundwater sampling data and the updated Sitewide conceptual/numerical model indicate that concentrations of COPCs in the SRPA will be equal to or less than applicable MCLs or regulatory guides in 2095 and beyond, then we can conclude that additional remedial measures are not needed.		The primary remedial action decisions for OU 10-08 will be based on results of numerical modeling that predict groundwater concentrations in the SRPA in 2095 and beyond. As such, the decisions will be based on estimated values for which specific error limits cannot be defined in a manner similar to traditional tolerance limits applied to laboratory analytical results. The accuracy of the computer predictions will be evaluated by comparing model predictions to observed concentrations.	The WAG 10 sampling and monitoring activities will include the following: Yearly sampling of 15 wells (guard and boundary wells) and sampling of 12 wells (baseline and distal) every 2 years will be used for compliance monitoring to evaluate contaminants entering and leaving the INL Site. The baseline wells will not be sampled in FY 2006, but the distal wells will be sampled in FY 2006. Vertical profile packer sampling of two wells (USGS-105 and USGS-108) on the INL boundary in FY 2006 and FY 2007. It is anticipated that two to three samples will be collected from each well. Vertical profile sampling will be performed at the two new wells (Middle-2050A and Middle-2051) with Westbay systems. Five intervals from each of the two Westbay installation wells will be sampled for FY 2006; then afterwards, the number of intervals will be reduced to two intervals from each well for FY 2007. It is anticipated that Westbay systems will be installed in three additional wells in FY 2006 and will be sampled in FY 2007 under this plan. These wells are USGS-132, USGS-133, and USGS-134 (Figure 3-1). Data loggers will be installed in 58 wells in FY 2006 to monitor Big Lost River infiltration and the groundwater gradient across the INL for one year. A post-ROD long-term monitoring plan will be developed after the ROD has been signed. The monitoring plan is expected to be revised after the OU 10-08 ROD is finalized. A geochemical study was performed in 2005 to delineate groundwater flow paths in the INTEC/RTC/RWMC area and to determine off-Site flow paths south of the INL Site boundary and the extent of contamination past the southern boundary of the INL Site. The low-detection limit VOC sampling was not performed in 2005 but will be performed in FY 2006 if a suitable laboratory can be found.		
	DR-1b. If, after 5 years of monitoring and incorporation of monitoring data into the refined OU 10-8 groundwater model, concentrations of COPCs in the SRPA are predicted to be greater than or equal to applicable MCLs or regulatory guides in 2095 and beyond, then additional remedial measures will be evaluated.				
COPC = contaminant of potential concern FY = fiscal year INL = Idaho National Laboratory INTEC = Idaho Nuclear Technology and Engineering Center MCL = maximum contaminant level RTC = Reactor Technology Complex RWMC = Radioactive Waste Management Complex SRPA = Snake River Plain Aquifer WAG = waste area group					

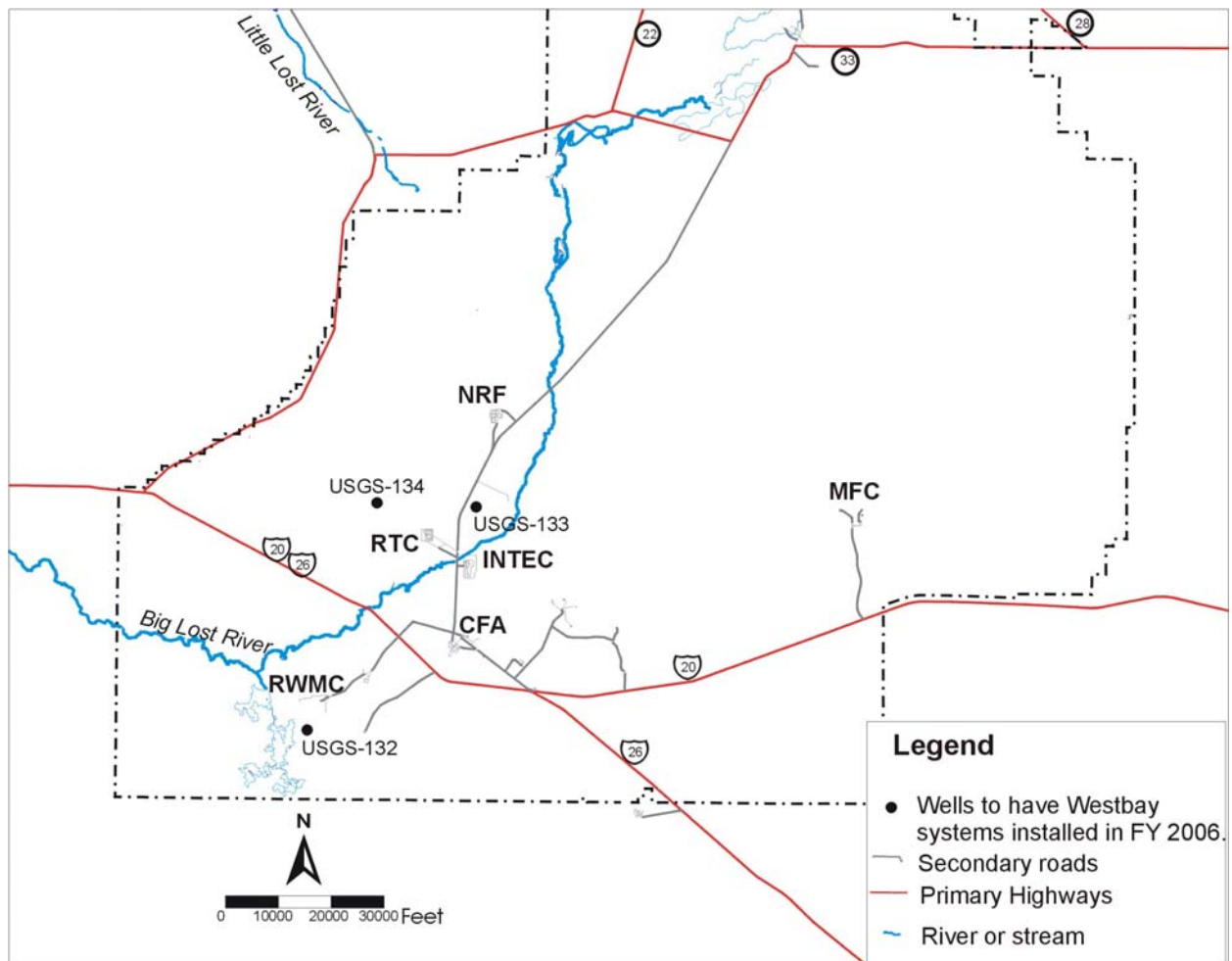


Figure 3-1. Locations of wells to have Westbay systems installed in Fiscal Year 2006.

4. FIELD ACTIVITIES

This section describes the field activities and procedures to be used to meet the DQOs discussed in Section 3. Before beginning any sampling activities, a pre-job briefing will be held with all work-site personnel to review the requirements of this plan, the health and safety plan (HASP) (INEEL 2004), and other work control documentation and to verify that all supporting documentation has been completed. Additionally, a post-job review will be conducted at the end of the sampling and instrument installation activities. The pre- and post-job briefings will be conducted in accordance with applicable procedures. The field team leader (FTL) (and other project personnel) will ensure that the fieldwork is being performed using the most current and applicable procedures.

4.1 Routine Sampling Locations and Laboratory Analytes

This sampling plan is for the RI/FS, but after the OU 10-08 ROD is signed, a comprehensive long-term monitoring plan will be developed. In a change to the previous OU 10-08 groundwater monitoring plan, the routine OU 10-08 sampling will include annual sampling of guard and boundary wells with baseline and distal wells to be sampled every 2 years (Figure 4-1). Table 4-1 lists well identifiers, well names, and other information about the wells to be sampled. Downgradient boundary and guard wells are sampled annually because they are considered the most important for determining compliance with MCLs and reaching cumulative risk thresholds in the groundwater from INL sources by FY 2095. Although previously sampled annually, baseline wells are to be sampled every 2 years because these wells monitor upgradient influences and a database now exists for evaluating that influence. The baseline wells will not be sampled in FY 2006, but will be sampled in FY 2007. Distal wells are sampled every 2 years to provide data to demonstrate that groundwater downgradient of the INL boundaries is not contaminated above MCLs or risk-based levels and to provide data for the groundwater model. Although sampled last year, the 2-year frequency for the distal wells will start in FY 2006; thus, distal wells will be sampled in FY 2006 but not in FY 2007.

Vertical profile sampling will be conducted at the two Westbay locations in FY 2006. All five sampling ports in Middle-2050A and Middle-2051 will be sampled in FY 2006, then sampling will be reduced to two ports in each well for FY 2007 and beyond. One sampling port will be continuously sampled on an annual basis. One of the other four ports will be sampled each year on a rotating basis depending upon the results of the second round of samples collected during FY 2006. After the data from the Westbay systems (to be sampled in June 2006) have been evaluated in the FY 2006 annual report, the sampling scheme will be finalized.

Packer sampling will be performed at USGS-105 and USGS-108 in FY 2006. These wells were selected because they are on the site boundary and they have Cl-36 concentrations above background (DOE-ID 2006). These wells have saturated open intervals of approximately 130 ft (USGS-105) and 150 ft (USGS-108). Two to three intervals will be sampled from each well depending on how much of the hole is open and the availability of good zones for inflating the packers. The intervals to be sampled will be determined after the pumps are removed and downhole videos of the holes have been examined. If the open hole portions of the wells have not collapsed, packer samples will be collected from USGS-105 and USGS-108 in FY 2006 and FY 2007.

4.1.1 Analytes for the Operable Unit 10-08 Remedial Investigation/Feasibility Study

The list of analytes for OU 10-08 monitoring is based on identified contaminants of concern (COCs) in the RODs for individual WAGs (Table 4-2). The COCs are discussed in greater detail in the OU 10-08 RI/FS work plan (DOE-ID 2002a). The WAG 10 routine monitoring includes all of the analytes in Table 4-2 except plutonium, Am-241, gamma spectrometry and uranium isotopes.

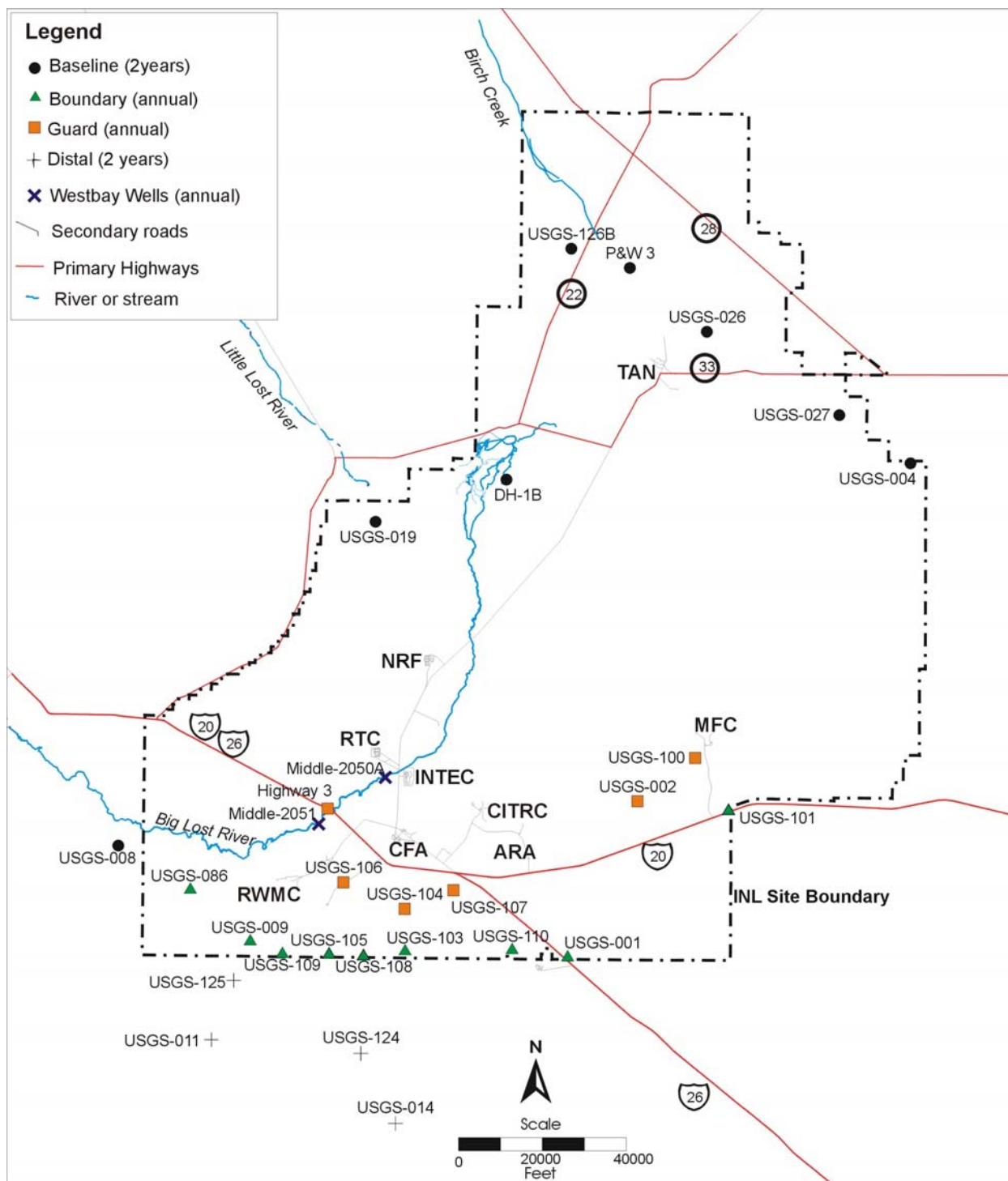


Table 4-1. Specific well information.

Well Identifier ^a	Well Name	Screened or Open Hole (ft)	Pump Depth (ft) ^b	Approximate Depth to Water (ft)
Boundary Wells				
450	USGS-001	600 to 630 perforated	612	588
458	USGS-009	620 to 650 perforated	635	607
535	USGS-086	48 to 691 open hole	678	649
550	USGS-101	750 to 865 perforated	790	771
552	USGS-103	575 to 760 open hole	700	583
554	USGS-105	400 to 800 open hole	700	670
557	USGS-108	400 to 760 open hole	637	609
558	USGS-109	600 to 800 open hole	656	621
559	USGS-110	580 to 780 open hole	612	566
Guard Wells				
184	Highway 3	680 to 750 perforated	567	538
451	USGS-002	675 to 696 perforated	683	659
549	USGS-100	662 to 750 open hole	703	686
553	USGS-104	550 to 700 open hole	592	555
555	USGS-106	605 to 760 open hole	609	584
556	USGS-107	270 to 690 open hole	531	477
Baseline Wells				
453	USGS-004	285 to 315 perforated 322 to 553 open hole	303	251
457	USGS-008	782 to 812 perforated	801	766
468	USGS-019	289 to 305 perforated	323	276
475	USGS-026	232 to 266.5 perforated	255	212
476	USGS-027	250 to 260 perforated 298 to 308 perforated	262	228
1346	USGS-126B	400 to 452 open hole	420	408
147	DH-1B	380 to 400 open hole	320	268
250	P&W-3	322 to 401 perforated	340	304
Distal Wells				
460	USGS-011	672.5 to 703.8 perforated	687	658 ^c
463	USGS-014	720 to 746 perforated	739	720 ^c
987	USGS-124	750 to 800 slotted	Not available	— ^c
988	USGS-125	620 to 774 slotted	700	634 ^c

Table 4-1. (continued).

Well Identifier ^a	Well Name	Screened or Open Hole (ft)	Pump Depth (ft) ^b	Approximate Depth to Water (ft)
Westbay Wells				
2050	Middle-2050A	Sampling port – 474	Not applicable	Not applicable
2050	Middle-2050A	Sampling port – 647	Not applicable	Not applicable
2050	Middle-2050A	Sampling port – 790	Not applicable	Not applicable
2050	Middle-2050A	Sampling port – 1005	Not applicable	Not Applicable
2050	Middle-2050A	Sampling port – 1212	Not Applicable	Not Applicable
2051	Middle-2051	Sampling port – 608	Not applicable	Not applicable
2051	Middle-2051	Sampling port – 748	Not applicable	Not applicable
2051	Middle-2051	Sampling port – 834	Not applicable	Not applicable
2051	Middle-2051	Sampling port – 1098	Not applicable	Not applicable
2051	Middle-2051	Sampling port – 1148	Not applicable	Not applicable

a. The well identifier is from the Hydrogeologic Data Repository.

b. The pump depth is the depth to the top of the pump.

c. Measurement was taken in October 2004. Well USGS-124 was not measured, because it was in use.

Table 4-2. Groundwater contaminants of concern identified in existing Records of Decision at the INL Site.

Contaminant Type	ROD-specified COC	Facility
VOCs:	Carbon tetrachloride	RWMC ^a
	cis-1,2-Dichloroethene	TAN ^b
	Methylene chloride (dichloromethane)	RWMC
	Tetrachloroethene	RWMC
	trans-1,2-Dichloroethene	TAN
	Trichloroethene	TAN
Inorganics:		
<i>Metals:</i>	Arsenic (As)	RTC ^c , INTEC ^d , MFC ^e
	Beryllium (Be)	RTC, CFA ^f
	Cadmium (Cd)	RTC, CFA
	Chromium (Cr)	RTC, INTEC, MFC
	Lead (Pb)	RTC
	Manganese (Mn)	RTC
	Mercury (Hg)	RTC, INTEC
	Zinc (Zn)	CFA
<i>Other:</i>	Fluoride (F)	RTC
	Nitrate (as nitrogen)	CFA, RWMC

Table 4-2. (continued).

Contaminant Type	ROD-specified COC	Facility
Radionuclides:		
	Gross alpha	Part of TAN, RTC, INTEC
	Gross beta	Part of TAN, RTC, INTEC
	Gamma spectrometry	Part of TAN, RTC, INTEC, RWMC
	Uranium (U) (U-233/234, -235, -238)	TAN, INTEC, RWMC
	Iodine-129 (I-129)	INTEC, RWMC
	Plutonium (Pu) (Pu-238, -239/240)	INTEC
	Americium-241 (Am-241)	INTEC
	Strontium-90 (Sr-90)	TAN, RTC, INTEC
	Technetium-99 (Tc-99)	INTEC, RWMC
	Tritium (H-3)	TAN, RTC, INTEC, RWMC
	Chloride-36 (Cl-36)	RWMC
	Carbon-14 (C-14)	RWMC

a. The COCs for groundwater at the RWMC are from DOE-ID (2004d).
b. The COCs for groundwater at TAN are from DOE-ID (1992a, 1995a, 1999a).
c. The COCs for groundwater at RTC are from DOE-ID (1992b, 1997).
d. The COCs for groundwater at INTEC are from DOE-ID (1999b).
e. Materials and Fuels Complex (formerly Argonne National Laboratory-West).
f. The COCs for groundwater at CFA are from DOE-ID (1995b, 2000).

Both plutonium and Am-241 are monitored near INTEC and the RWMC by WAGs 3 and 7, respectively. Because of the low mobility for plutonium and Am-241, they were not included in the routine OU 10-08 monitoring.

In previous sampling events for WAG 10, gamma spectrometry and uranium isotopes (U-233/234, U-235, and U-238) were included. Gamma spectrometry has been eliminated since the analytes associated with this analysis do not form plumes or have low mobility (such as Cs-137). Uranium isotopes have been eliminated since a uranium plume has not been detected at upgradient facilities and concentrations in previous OU 10-08 samples have been at background levels. A total uranium concentration will be determined in the metals analysis.

Samples will be analyzed for VOCs, metals (filtered), anions (includes chloride, sulfate, bromide, and fluoride), nitrate/nitrite as nitrogen, alkalinity (total as CaCO₃), tritium, I-129, gross alpha, gross beta, Tc-99, and Sr-90 (Table 4-3). The standard VOC list rather than the Appendix IX VOC list (EPA 1996) is being analyzed in FY 2006 because the VOCs that are COCs at upgradient facilities (e.g., carbon tetrachloride, TCE, and PCE) are included in the standard VOC analysis. Detection limits for select analytes and regulatory levels also are shown in Table 4-3. In FY 2006, the Westbay samples from Middle-2051 also will be sampled for C-14 in addition to the analytes mentioned above, as requested by WAG 7.

Every other year starting in 2005, the I-129 analysis for the boundary and distal wells will use the low-detection limit AMS method used by the Purdue Rare Isotope Measurement Laboratory at Purdue University. Because that laboratory is a research laboratory, rather than a commercial laboratory, it will not produce the data package that typically accompanies other data and does not guarantee turnaround times. Consequently, the data will not be validated and might not be received in a timely manner.

Table 4-3. Operable Unit 10-08 analytes and required quantitation levels.

Contaminant Type	Contaminant Name	Action Level or MCLs	Practical Quantitation Limit or Level Required (at least half MCL)
VOCs	Carbon tetrachloride	0.005 mg/L	0.001 mg/L ^a
	cis-1,2-Dichloroethene	0.07 mg/L	0.001 mg/L ^a
	Methylene chloride	0.005 mg/L	0.001 mg/L ^a
	Tetrachloroethene	0.005 mg/L	0.001 mg/L ^a
	trans-1,2-Dichloroethene	0.1 mg/L	0.001 mg/L ^a
	Trichloroethene	0.005 mg/L	0.001 mg/L ^a
Inorganics (Contract Laboratory Program metals plus uranium, and strontium)	Arsenic	0.05 mg/L	0.005 mg/L
	Beryllium	0.004 mg/L	0.001 mg/L
	Cadmium	0.005 mg/L	0.001 mg/L
	Chromium	0.1 mg/L (total)	0.002 mg/L
	Lead	0.015 mg/L	0.002 mg/L
	Mercury	0.002 mg/L	0.0001 mg/L
	Zinc	5 mg/L (SDWS [5])	0.020 mg/L
Anions	Nitrate (as nitrogen)	10 mg/L	0.5 mg/L
	Chloride	250 mg/L (SDWS [5])	0.5 mg/L
	Alkalinity (total)	Not applicable	10 mg/L
	Fluoride	4.0 mg/L (2.0 mg/L SDWS [5])	0.5 mg/L
	Sulfate	250 mg/L (SDWS [5])	1 mg/L
Radionuclides ^b	Gross alpha	15 pCi/L (total)	2 pCi/L
	Gross beta (manmade)	Not to exceed 4 mrem/year to the whole body or any organ	4 pCi/L
	I-129	1 pCi/L	0.2 pCi/L
	Sr-90	8 pCi/L	0.5 pCi/L
	Tc-99	900 pCi/L	10 pCi/L
	H-3	20,000 pCi/L	400 pCi/L

a. Based on 25-mL sample volume.

b. In addition, the Westbay samples from Middle-2051 will be analyzed for C-14 as requested by WAG 7.

MCL = maximum contaminant level

SDWS = secondary drinking water system

VOC = volatile organic compound

WAG = waste area group.

4.1.2 Operable Unit 10-08 Sampling Schedule

The OU 10-08 routine groundwater monitoring in support of the RI/FS is scheduled for June and July of each year until the OU 10-08 ROD is signed. Figure 4-1 shows the wells that will be sampled routinely; well construction details are provided in Table 4-1. Note that the geochemical study discussed below is a one-time sampling event.

4.2 Geochemical Study

A geochemical study was conducted in FY 2005 to attempt to resolve the source of the tritium in the aquifer at RWMC (DOE-ID 2004e), identify flow paths of contaminants from INTEC and RTC, determine the source of the anion anomaly south of the RWMC, identify flow paths, and evaluate contaminant influence south of the southern INL Site boundary. Additional samples that may be taken as part of the geochemical study include I-129 from M7S and the RWMC production well and CI-36 from the upper three sampling ports at Middle-2051 and M7S.

Because a suitable laboratory could not be found, the low-detection limit VOC study was not performed in FY 2005. The low-detection limit VOC sampling will only be performed in FY 2006 if a laboratory that can perform the analyses is found. Carbon tetrachloride, dichlorodifluoromethane (F-12), trichloroethene, and 1,1,2-trichloro-1,2,2-trifluoroethane (F-113) will be sampled in four wells: USGS-009, -105, -109, and -125 (all located along the southern boundary of the INL Site) and analyzed using a low-detection limit (approximately 0.01 to 0.001 µg/L) VOC analysis method. This analysis is in addition to the standard analytical method for VOCs. The locations of these four wells are shown on Figure 4-1. The goal of the low-detection limit sampling is to evaluate migration paths from the RWMC and the potential for plumes from the RWMC to mix with plumes from INTEC and RTC. By using the low-detection limit VOC method, it might be possible to detect carbon tetrachloride in some of the wells south of RWMC. The USGS has tracked a low-concentration F-113 plume from RWMC past the southern boundary of the INL Site (Busenberg et al. 2001). The detection of carbon tetrachloride in any of the four wells would further substantiate the migration path indicated by the F-113 data.

4.3 Sampling Quality Assurance/Quality Control and Performance Evaluation Samples

Section 6 of this plan and the QAPjP (DOE-ID 2004a) require quality assurance/quality control (QA/QC) samples from the SRPA samples. Laboratories on the Idaho Cleanup Project (ICP) Qualified Suppliers List will be used for the analyses of all such samples. The QA/QC samples will be collected at the frequency recommended in the QAPjP. The QA/QC samples for the groundwater sampling will include duplicates and could include rinsate samples. Duplicate samples will be collected at a frequency of 1 per 20 samples.

Performance evaluation (PE) samples could be sent to the laboratory(ies) during the sampling event. The PE samples might be spiked with a single analyte or multiple analytes. The need for the PE samples will be evaluated before each sampling event.

4.4 Water Level Measurement Locations and Schedule

Data loggers will be installed in 58 wells to monitor Big Lost River infiltration and the groundwater gradient across the INL for one year (Figure 4-2 and Table 4-4). Water level measurements will be made approximately every 3 months in FY 2006 in Wells Middle-2050A and Middle-2051 located

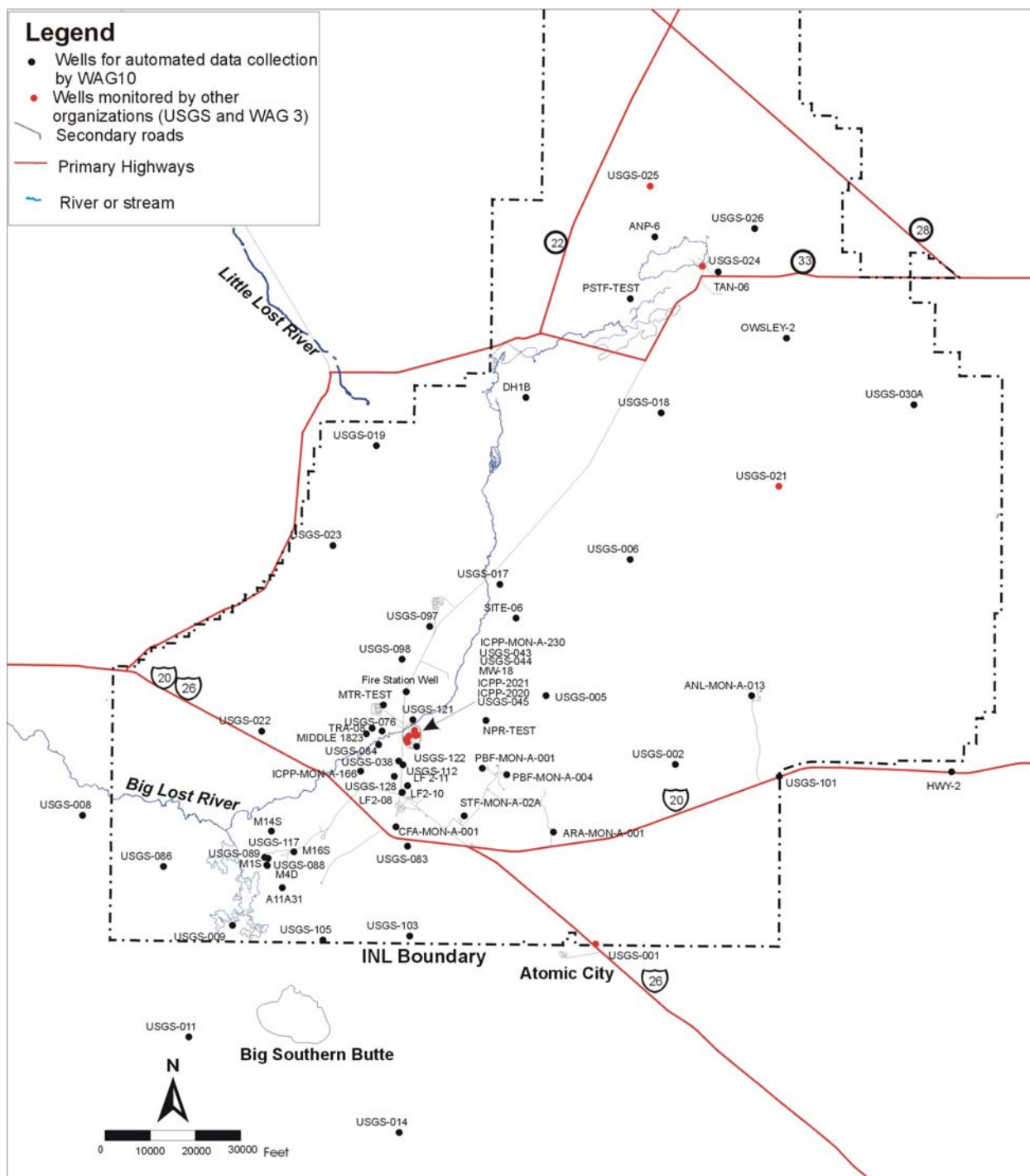


Table 4-4. Wells selected for automated monitoring, with relevant information on well completion and water table elevation.

Well Name	Well ID Number	Corrected June 2005 Depth to Water (ft bls)	Land Surface Datum (ft msl)	Water Table Elevation (ft msl)	Completion Depth	Depth of		Depth of Lowest Open Interval Below WT (ft)
						Top Open/Screen Interval (ft bls)	Bottom Open/Screen Interval (ft bls)	
ANL-MON-A-013	1075	646.26	5120.37	4474.11	662	637	662	16
ANP-6	74	225.95	4797.49	4571.54	305	211	316	90
ARA-MON-A-001	1003	596.00	5034.30	4438.30	640	620	640	44
CFA-MON-A-001	1077	496.62	4936.44	4439.82	527	488	518	21
DHIB	147	284.24	4792.33	4508.09	380	380	400	116
FIRE STATION WELL	158	438.50	4901.13	4462.63	516	423	511	73
HWY-2	183	734.95	5216.55	4481.60	786	741	786	51
ICPP-MON-A-166	1352	509.52	4956.00	4446.48	527	487	527	17
LF 2-11	199	481.96	4928.36	4446.40	499	466	499	17
LF2-10	198	488.04	4932.48	4444.44	766	725	765	277
LF2-08	196	485.08	4931.72	4446.64	526	485	495	10
M1S	765	590.58	5011.09	4420.51	638	608	638	47
M4D	767	600.85	5022.53	4421.68	838	798	828	227
MIDDLE 1823	1823	492.62	4939.36	4446.74	720	680	720	227
MTR-TEST	231	469.40	4917.15	4447.75	588	447	588	119
NPR-TEST	239	472.68	4933.15	4460.46	600	504	532	59
OWSLEY-2	247	234.30	4786.87	4552.57	310	252	304	70
PBF-MON-A-001	1085	451.72	4906.15	4454.43	489	454	484	32
PBF-MON-A-004	1094	500.29	4939.66	4439.36	522-542	522	542	42
PSTF-TEST	256	219.15	4786.37	4567.22	319	190	316	97
A11A31	906	646.67	5065.40	4418.73	675	635	675	28
SITE-06	274	369.69	4836.17	4466.48	523	366	464	95
M14S	1215	610.15	5032.46	4422.31	645	584	635	24
M16S	1339	582.94	5004.34	4421.40	578	578	613	30
STF-MON-A-02A	999	502.39	4937.30	4434.91	530	510	530	28

Table 4-4. (continued).

Well Name	Well ID Number	Corrected June 2005 Depth to Water (ft bls)	Land Surface Datum (ft msl)	Water Table Elevation (ft msl)	Completion Depth	Depth of		Depth of Lowest Open Interval Below WT (ft)
						Top Open/Screen Interval (ft bls)	Bottom Open/Screen Interval (ft bls)	
TAN-06	746	218.60	4786.87	4568.27	261	235	255	36
TRA-08	732	488.15	4934.93	4446.78	502	472	502	14
USGS-002	451	668.96	5125.99	4457.03	704	675	696	27
USGS-005	454	477.45	4937.79	4460.34	453	475	497	20
USGS-006	455	423.97	4899.12	4475.15	620	452	620	196
USGS-008	457	774.00	5195.57	4421.57	812	782	812	38
USGS-009	458	615.26	5031.86	4416.61	654	620	650	35
USGS-011	460	658.79	5067.22	4408.43	704	673	704	45
USGS-014	463	721.38	5133.08	4411.70	752	720	746	25
USGS-017	466	366.53	4834.01	4467.48	498	438	498	131
USGS-018	467	282.34	4804.82	4522.47	329	299	324	42
USGS-019	468	281.46	4800.62	4519.16	399	285	306	24
USGS-022	471	618.57	5048.74	4430.17	657	619	655	36
USGS-023	472	413.16	4884.67	4471.51	463	410	430	17
USGS-026	475	220.70	4789.53	4568.83	267	232	267	46
USGS-030A	479	269.39	4794.84	4525.45	300	290	300	31
USGS-038	487	482.79	4929.63	4446.84	724	678	729	246
USGS-076	525	482.87	4929.70	4446.83	718	457	718	235
USGS-083	532	505.96	4941.59	4435.63	752	516	752	246
USGS-084	533	491.13	4937.90	4446.77	505	210	505	14
USGS-086	535	656.39	5077.04	4420.65	691	48	691	35
USGS-088	537	599.65	5021.26	4421.61	663	584	635	35
USGS-089	537	609.25	5029.87	4420.62	646	576	646	37
USGS-097	546	393.16	4858.95	4465.78	510	388	510	117
USGS-098	547	423.14	4883.29	4460.16	505	401	505	82
USGS-101	550	780.07	5251.60	4471.52	865	750	865	85

Table 4-4. (continued).

Well Name	Well ID Number	Corrected June 2005 Depth to Water (ft bls)	Land Surface Datum (ft msl)	Water Table Elevation (ft msl)	Completion Depth	Depth of Top Open/Screen Interval (ft bls)	Depth of Bottom Open/Screen Interval (ft bls)	Depth of Lowest Open Interval Below WT (ft)
USGS-103	552	587.92	5007.41	4419.49	760	575	760	172
USGS-105	554	676.33	5095.09	4418.75	800	400	800	124
USGS-112	561	480.92	4927.84	4446.91	563	430	563	82
USGS-117	566	591.96	5012.74	4420.78	655	550	653	61
USGS-121	570	461.66	4909.65	4447.99	485	449	475	13
USGS-122	571	466.38	4913.76	4447.37	483	449	475	9
USGS-128	1413	488.37	4934.92	4446.55	615	457	615	127
Wells Monitored by WAG 3								
ICPP-MON-A-230	1442	464.62	4912.41	4447.54	483	443	483	19
ICPP-2020	2020	465.94a	4914.36	4448.42	495	455	495	29
ICPP-2021	2021	464.02a	4912.14	4448.12	493.4	453	493.4	29
USGS-043	492	468.24	4916.05	4447.74	675.8	450.5	675.8	207
USGS-044	493	470.00	4917.93	4447.68	650	461	650	180
USGS-045	494	471.09	4918.30	4447.00	651	461	651	180
MW-18	1187	466.37	4913.74	4447.12	478.5	458.5	478.5	22
Wells Monitored by the USGS								
USGS-024	473	227.27	4795.82	4568.46	325	255 ^b	325	98
USGS-025	474	280.59	4849.44	4568.79	320	285	320	40
USGS-021	470	DRY	4838.99	NA	400	360	400	NA
USGS-001	450	594.69	5022.71	4428.21	630	600	630	35

a. Water-levels for ICPP-2020 and ICPP-2021 are from May 2005.

b. USGS-024 has three screened intervals: 255 to 265; 270 to 275; and 285 to 325.

bls = below land surface

msl = mean sea level

NA = not available

USGS = United States Geological Survey

WAG = waste area group

WT = water table

near the Big Lost River (Figure 4-1). The need and frequency for the water level measurements in the two above-noted wells will depend on flow in the Big Lost River. The Sitewide water-level measurement campaigns of the previous 2 years indicated that Sitewide water levels do not vary in direction and gradient sufficiently to warrant yearly water-level monitoring across the entire Site when the Big Lost River does not flow.

If measured, water levels will be measured with an electronic measuring tape (Solinst brand or equivalent) or a steel tape measure scaled in feet with markings to 0.01 ft. Water level measurements will be recorded to the nearest 0.01 ft. Water levels will be measured according to the latest ICP procedure.

5. GROUNDWATER SAMPLING PROCEDURES AND EQUIPMENT

This section describes procedures and the equipment to be used for routine OU 10-08 sampling and monitoring and for the geochemical study. Before any sampling begins, a pre-sampling meeting will be held to review the requirements of this plan, the HASP (INEEL 2004), any applicable company policies and procedures, and to ensure that all supporting documentation has been completed. Figure 4-1 shows the wells to be sampled as part of the routine OU 10-08 sampling.

5.1 Groundwater Elevations

Prior to sampling, all groundwater elevations will be measured using either an electronic measuring tape (Solinist brand or equivalent) or a steel tape measure, as described in the latest ICP standard operating procedure. Measurement of all water levels will be recorded to the nearest 0.01 ft.

5.2 Well Purging

Before collecting a sample from any aquifer water well, the well must be purged. The Westbay wells will be sampled according to the manufacturer's recommendations, which usually do not include purging. During the purging operation, a Hydrolab (or equivalent) will be used to measure specific conductance, pH, and temperature. The pH, temperature, and specific conductance readings will be compiled from the logbooks and used in the geochemical analysis. Well purging will follow the latest ICP procedure. A sample for water quality analysis can be collected after a minimum of three well casing volumes of water have been purged from the well and when three consecutive water-quality parameter measurements separated by at least 10% of the purge volume or 5 minutes are within the following limits:

- pH ± 0.1
- Temperature $\pm 0.5^{\circ}\text{C}$
- Specific conductance $\pm 10 \mu\text{mhos/cm}$.

5.3 Groundwater Sampling

Prior to sampling, all nondedicated sampling equipment that will come in contact with the water sample will be cleaned using the latest ICP procedure for decontamination of field sampling equipment. After sampling, all nondedicated equipment that came in contact with the well water will be decontaminated before storage in accordance with the latest ICP procedure.

Prior to purging, the water level in each well will be measured. The well will then be purged a minimum of three well-casing volumes until the pH, temperature, and specific conductance of the purge water have stabilized or until a maximum of four well-casing volumes have been removed. If parameters are still not stable after four volumes have been removed, samples will be collected and appropriate notations will be recorded in the logbook. The Westbay systems will be sampled according to the latest ICP standard operating procedure.

Routine groundwater samples will be analyzed for the analytes listed in Table 4-3. The requirements for containers, preservation methods, sample volumes, holding times, and analytical methods will be in the laboratory statement of work to be prepared before sampling.

Except for volatile organic analyte vials that must be filled completely, sample bottles will be filled to approximately 90 to 95% of capacity to allow for content expansion or preservation. Samples to be analyzed for metals (target analyte list metals plus boron) will be filtered through a 0.45- μm filter in the field prior to acidification. Samples requiring acidification will be acidified to a pH <2 in the field.

5.4 Personal Protective Equipment

The personal protective equipment (PPE) required for this sampling effort is discussed in the project HASP (INEEL 2004). Before disposal, all PPE will be characterized for disposal or decontamination based on groundwater and field screening results. A hazardous waste determination for all PPE will be made using applicable company policies and procedures.

6. SAMPLE CONTROL

Strict sample control is required for any project. Sample control ensures that unique sample identifiers are used for separate samples. It also covers the documentation of sample collection information so that a sampling event can be reconstructed at a later date. The following subsections provide details about sample designation, handling, shipping, and radiological screening.

6.1 Sample Designation

A systematic code is crucial for the unique identification of samples. Uniqueness is required for maintaining consistency within a project and preventing the same identification code from being assigned to more than one sample.

6.1.1 Sample Identification Code

A systematic character identification code will be used to uniquely identify all samples. The first three designators of the code (i.e., GWM) indicate that the sample originated from groundwater monitoring activities. The next three numbers designate the sequential sample number for the project. The seventh and eighth characters represent a two-character set (e.g., 01, 02) for designation of field duplicate samples. The last two characters refer to a particular analysis and bottle type.

For example, a groundwater sample collected in support of the OU 10-08 monitoring might be designated as GWM00101AN, where (from left to right):

- GWM designates the sample as being collected for OU 10-08
- 001 designates the sequential sample number
- 01 designates the type of sample (01 = original, 02 = field duplicate)
- AN designates anion analysis.

A sampling and analysis plan (SAP) table/database will be prepared before sampling and used to record all pertinent information (e.g., well designation, media, and date) associated with each sample identification code.

6.1.2 Sampling and Analysis Plan Table/Database

6.1.2.1 General. A SAP table format was developed to simplify the presentation of the sampling scheme for project personnel. The following subsections describe the information recorded in the SAP table/database.

6.1.2.2 Sample Description Fields. The sample description fields contain the following information about individual sample characteristics:

- **Sampling Activity**—The sampling activity field contains the first six characters of the assigned sample number. The sample number in its entirety will be used to link information from other sources (e.g., field data and analytical data) to the information in the SAP table for data reporting, sample tracking, and completeness reporting. The sample number also will be used by the analytical laboratory to track and report analytical results.

- **Sample Type**—Data in this field will be selected from the following:
 - REG for a regular sample
 - QC for a quality control sample.
- **Media**—Data in this field will be selected from the following:
 - GROUNDWATER for water collected from groundwater
 - WATER for regular and QA/QC samples of groundwater.
- **Collection Type**—Data in this field will be selected from the following:
 - GRAB for grab samples (undisturbed and disturbed core sample)
 - FBLK for field blanks
 - RNST for rinsates
 - DUP for duplicates
 - TBLK for volatile organic analyte trip blanks.
- **Sampling Method**—Data in this field are related to what the sample is taken from. This field can be left blank.

6.1.2.3 Planned Date. This date is related to the planned sample collection start date.

6.1.2.4 Sample Location Fields. This group of fields pinpoints the exact location for the sample in three-dimensional space, starting with the general area, narrowing the focus to an exact location geographically, and then specifying the depth in the depth field, as follows:

- **Area**—The area field identifies the general sample collection area. This field should contain the standard identifier for the INL area being sampled. For this investigation, samples are being collected from sites designated as WAG 10 OU 10-08 groundwater. The area field identifier will correspond to this site.
- **Location**—This field generally contains program-specific information such as the borehole or well identification number but can contain geographical coordinates, x-y coordinates, building numbers, or other location-identifying details. Data in this field will normally be subordinate to the area. This information is included on the labels generated by SAM to aid field sampling personnel.
- **Type of Location**—This field supplies descriptive information about the exact sample location. Information in this field can overlap with that in the location field, but the information is intended to add detail about the location.
- **Depth**—The depth of a sample location is the distance in feet from ground surface or a range in feet from the surface.

6.1.2.5 **Analysis Types**

- **AT1–AT20**—These fields indicate analysis types (e.g., radiological and chemical) and the number to be collected for each sample number. Space is provided at the bottom of the form to clearly identify each type. A standard abbreviation also is provided for each analysis below the Analysis Types cell.

6.2 **Sample Handling**

Samples for laboratory analyses will be collected in pre-cleaned containers and packaged according to American Society for Testing and Materials, or EPA-recommended, procedures. The quality assurance samples will be included to satisfy the QA/QC requirements for the field operation, as outlined in the QAPjP (DOE-ID 2004a). Laboratories on the ICP Qualified Suppliers list will analyze the samples.

6.2.1 **Sample Preservation**

Immediately after collection, all groundwater, rinsate, and QA/QC samples will be placed in coolers containing frozen, reusable ice packs or ice. Samples that require cooling will be maintained at 4°C (39°F) beginning immediately after sample collection, and throughout sample shipment. After preservation, sample coolers will have chain-of-custody (CoC) seals attached.

6.2.2 **Chain-of-Custody Procedures**

The CoC forms will be completed following applicable company procedures and the QAPjP (DOE-ID 2004a). Sample containers will be stored in a secured area accessible only to the field team members.

6.2.3 **Transportation of Samples**

Samples will be shipped in accordance with the regulations issued by the Department of Transportation (DOT) (49 CFR 171 through 178) and EPA sample-handling, -packaging, and -shipping methods (40 CFR 261.3). Samples will be packaged in accordance with the requirements set forth in company policies and procedures.

6.2.3.1 Custody Seals. Custody seals will be placed on all shipping containers in a way that ensures tampering or unauthorized opening does not compromise sample integrity. Clear plastic tape will be placed over the seals to ensure that they are not damaged during shipment.

6.2.3.2 On- and Off-Site Shipping. An on-Site shipment is any transfer of material within the perimeter of the INL Site. Site-specific requirements for transporting samples within INL Site boundaries and those required by the shipping and receiving department will be followed. Shipment within the INL Site boundaries will conform to DOT requirements as stated in 49 CFR. Off-site sample shipment will be coordinated with Packaging and Transportation personnel, as necessary, and will conform to all applicable DOT requirements.

7. QUALITY ASSURANCE/QUALITY CONTROL

A QAPjP has been developed for WAGs 1, 2, 3, 4, 5, 6, 7, and 10 (DOE-ID 2004a). The QAPjP pertains to all environmental and radiological testing, analysis, and data review. This section details the field elements of the QAPjP to support field operations during implementation of this field sampling plan.

7.1 Project Quality Objectives

Quality assurance objectives specify the measurements that must be met to produce acceptable data for a project. The technical and statistical qualities of those measurements must be properly documented. Precision, accuracy, and completeness are quantitative parameters that must be specified for physical/chemical measurements. Comparability and representativeness are qualitative parameters.

Quality assurance objectives for this project will be met through a combination of field and laboratory checks. Field checks will consist of collecting field duplicates, equipment blanks, and field blanks. Laboratory checks consist of initial and continuing calibration samples, laboratory control samples, matrix spikes, and matrix spike duplicates. Laboratory quality assurance is detailed in the QAPjP (DOE-ID 2004a) and is beyond the scope of this plan.

7.1.1 Field Precision

Field precision is a measure of the variability not attributed to laboratory or analytical methods. The three types of field variability or heterogeneity are spatially within a data population, between individual samples, and within an individual sample. Although the heterogeneity between and within samples can be evaluated using duplicate and/or sample splits, overall field precision will be calculated as the relative percent difference between two measurements or the relative standard deviation between three or more measurements. The relative percent difference or relative standard deviation will be calculated as indicated in the QAPjP (DOE-ID 2004a) for duplicate samples during the data validation process. Precision goals have been established for inorganic Contract Laboratory Program methods by the EPA (EPA 1993) and for radiological analyses in the applicable SAM procedures.

Duplicate samples to assess precision will be collocated and collected by field personnel at a minimum frequency of one duplicate for every 20 samples, with the location of the QA/QC samples being rotated between sampling events.

7.1.2 Field Accuracy

Cross contamination of the samples during collection or shipping could yield incorrect analytical results. To assess the occurrence of any cross contamination, equipment blanks and field blanks will be collected. The goal of the sampling program is to eliminate any cross contamination associated with sample collection or shipping. Analytical results for these samples will be evaluated during the data validation process by sample delivery group. If necessary, the data will be blank-qualified to indicate the absence or presence of cross contamination.

Field personnel will collect rinsate, equipment, and field blanks during the course of the project. The rinsate, equipment, and field blanks will be collected at a frequency of one every 20 samples or once for every sample day, whichever is less (DOE-ID 2004a). If activities that could contaminate the samples are identified during sampling, additional blank samples can be collected at the discretion of the FTL.

7.1.3 Representativeness

Representativeness is evaluated by assessing the accuracy and precision of the sampling program and expressing the degree to which samples represent actual site conditions. In essence, representativeness is a qualitative parameter that addresses whether the sampling program was properly designed to meet the DQOs. The representativeness criterion is best satisfied by confirming that a sufficient number of samples are collected to meet the requirements stated in the DQOs. The DQOs are identified in Section 3 of this plan.

7.1.4 Comparability

Comparability is a qualitative measure of the confidence with which one data set can be compared to another. These data sets include data generated by different laboratories performing this work, data generated by laboratories in previous studies, data generated by the same laboratory over a period of several years, or data obtained using differing sampling techniques or analytical protocols. For field aspects of this program, data comparability will be achieved using standard methods of sample collection and handling. Procedures identified to standardize the sample collection and handling are included in applicable company policies and procedures.

7.1.5 Completeness

Field completeness will be assessed by comparing the number of samples collected to the number of samples planned. Field sampling completeness is affected by such factors as equipment and instrument malfunctions and insufficient sample recovery. Completeness can be assessed after data validation and reduction. The completeness goal for this project is 90%.

7.2 Data Validation

All laboratory-generated data, except for stable isotope data and low-detection limit I-129 and Cl-36 data, will be validated to Level B; however, a Level A data package will be requested from the laboratory. Data will be validated in accordance with company procedures. Field-generated data (e.g., conductivity, temperature, dissolved oxygen, and pH) will be validated through the use of properly calibrated instrumentation, comparing and cross checking data with independently gathered data, and recording data-collection activities in a bound field logbook.

7.3 Quality Assurance Objectives for Measurement

The quality assurance objectives are specifications that the monitoring and sampling measurements identified in the QAPjP (DOE-ID 2004a) must meet to produce acceptable data for the project. The technical and statistical quality of these measurements must be properly documented. Precision, accuracy, method detection limits, and completeness must be specified for chemical measurements. Quality assurance objectives are specified in the QAPjP for WAGs 1, 2, 3, 4, 5, 6, 7, and 10 (DOE-ID 2004a).

8. PROJECT ORGANIZATION AND RESPONSIBILITIES

The organizational structure for this project reflects the resources and expertise required to perform the work while minimizing the risks to worker health and safety. Key project positions at the INL and within the Miscellaneous Sites Cleanup Project structure are outlined in the HASP (INEEL 2004). The HASP is divided into two sections that outline the responsibilities of key ICP personnel. The HASP also discusses key personnel who will be directly associated with the job site (i.e., on-Site personnel).

9. WASTE MANAGEMENT

The disposition of investigation-derived waste will be coordinated with the appropriate Waste Generator Services (WGS) interface to ensure compliance with applicable waste-storage, -characterization, -treatment, and -disposal requirements.

Investigation-derived waste produced during sampling will include spent and unused sample material, PPE, miscellaneous sampling supplies, decontamination water, purge water, and samples. WGS will provide a determination for the disposition of all waste, including purge water, based on a waste determination and disposition form. In addition, Appendix G of the OU 10-08 RI/FS work plan (DOE-ID 2002a) includes instructions for handling investigation-derived waste for this project.

Before sampling begins, the project will provide the field team with the WGS determination and waste disposition form for each well. That form describes the required disposal option for purge water. Purge water from most of the wells to be sampled under this plan is anticipated to be eligible for release to the ground surface. In addition, to help ensure the purge volume is correct, the project will provide samplers with the approximate volume of water purged from the well during a previous sampling round.

If the purged groundwater must be containerized for specific wells because of radionuclides, chemicals, or regulatory restrictions, then the well will not be sampled until a disposal option is available. If possible, for example, sites that have specific purge water disposal restrictions will be sampled concurrently with other programs or WAGs to eliminate duplication and provide the most efficient and compliant management of purge water by those programs.

10. HEALTH AND SAFETY

A HASP has been prepared to define the health and safety requirements for this project (INEEL 2004). The HASP establishes the procedures and requirements that will be used to minimize health and safety risks to persons working on the OU 10-08 project. The HASP meets the requirements of 29 CFR 1910.120 and 29 CFR 1926.65. Preparation of the HASP was consistent with information found in the following documents:

- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH/OSHA/USCG/EPA 1985)
- Company manuals.

The HASP governs all work that is performed by INL personnel and INL subcontractors or employees of other companies in support of OU 10-08. Persons not normally assigned to work at the Site—such as representatives of DOE, DOE Idaho, the State of Idaho, the Occupational Safety and Health Administration, and EPA—are considered occasional workers, as stated in 29 CFR 1910.120 and 29 CFR 1926.65.

11. DOCUMENT MANAGEMENT

This section summarizes document-management and sample-control activities that will be performed during this project. Documentation includes CoC forms, sample container labels, and field logbooks used to record field data and sampling procedures. The analytical results from this field investigation will be documented in reports and used as input for refining the current conditions for the computer model.

11.1 Documentation

The FTL will be responsible for controlling and maintaining all field documents and records and for verifying that all required documents submitted to ICP SAM are maintained in good condition. All entries will be made in indelible black ink. Errors will be corrected by drawing a single line through the error and entering the correct information. All corrections will be initialed and dated by the person making the correction.

11.1.1 Sample Container Labels

Waterproof, gummed labels generated from the SAP database will display information such as the unique sample identification number, the name of the project, the sample location, and the analysis type. Labels will be completed and placed on the containers in the field before samples are collected. Sample team members will provide information needed to complete the label. Such information may include the date and time the sample was collected, the preservative used, field measurements of hazards, and the sampler's initials.

11.1.2 Field Guidance Form

Field guidance forms verifying unique sample numbers provided for each sample location can be generated from the SAP database. These forms contain the following information:

- Media
- Sample identification numbers
- Sample location
- Aliquot identification
- Analysis type
- Container size and type
- Sample preservation.

11.1.3 Field Logbooks

Field logbooks will be used to record information necessary to interpret the analytical data in accordance with the SAM format. The logbooks will be controlled and managed in accordance with company policies and procedures.

11.1.3.1 FTL's Daily Logbook. A project logbook maintained by the FTL will contain a daily summary of the following:

- All field team activities necessary to reconstruct the events and methods used to accomplish the objectives of this field sampling plan
- Visitor log (a site visitor logbook can be assigned to record this information)
- List of site contacts
- Problems encountered
- Corrective actions taken as a result of field audits.

The project logbook will be signed and dated at the end of each day's sampling activities.

11.1.3.2 Sample Logbooks. Sample logbooks will be used by the sample team(s). Each sample logbook will contain information such as the following:

- Physical measurements
- Identification of quality control samples
- Sample information (i.e., sample location, sample collection information, analyses requested for each sample, and sample matrix)
- Shipping information (i.e., collection dates, shipping dates, cooler identification number, destination, CoC number, and name of shipper).

11.1.3.3 Field Instrument Calibration/Standardization Logbook. A logbook containing records of calibration data will be maintained for each piece of equipment that requires periodic calibration or standardization. This logbook will contain logsheets to record the date and time of calibration, the method of calibration, and the instrument identification number.

11.1.4 Photographs

No formal photographic records of the activities conducted under this plan are expected to be made. Field personnel can take photographs to record general equipment setups and installation procedures. A minimum of two copies will be made of any photographs taken during this project. One copy will be placed in the project file. The second copy will accompany other project documents (e.g., field logbooks) to be placed in the Document Control and Records Management files.

11.2 Document Revision Requests

Currently, at least one revision of this plan is anticipated in order to include three new Westbay systems scheduled to be installed in FY 2006 in USGS-132, -133 and -134. It also might be necessary to revise this document to add or delete wells and analytes, depending on the results and interpretation of data collected under this plan or the results of groundwater monitoring by other WAGs or agencies. Revisions of this document will follow company policies and procedures. Final changes must be approved through the supervising regulatory agencies, because this is a secondary FFA/CO document.

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